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ABSTRACT

A teaching method developed for a class of Taiwanese nuclear engineers studying at Oregon State University emerged from a situation in which the English for Science and Technology (EST) instructor did not have extensive experience with the technical language of the field. The design of the lessons was based on the assumption that the students already knew the science content, and the use of their knowledge was integral to the instructional program. In opening comments to the students, the teacher assumed responsibility for the language of the lessons and assigned to the students responsibility for the scientific matter. As a result, the students appreciated recognition of their specialized skills, came to contribute their knowledge freely, and enjoyed the opportunity to practice the language in contexts relevant to their special situations. Lessons covered such topics as definition, classification, conceptual paragraphing, compounding, nontemporal verb choice, and implicit information. A sample lesson reviewing definition and classification and introducing conceptual paragraphing and implicit information illustrates the method used. It is concluded that the technique relieves the language teacher of trying to teach what he does not know, and in this case resulted in an exceptionally good teaching situation despite some initial nervousness. (MSE)

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TEACHING EST WITHOUT BECOMING A SCIENTIST

A Practical Technique

by

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Introduction

One of the continuing problems of teaching the English of Science and Technology (EST) to scientists is the development of methods that take into account the fact most language teachers do not have extensive scientific educations. Many, in fact, come to language with a background in the humanities and are understandably hesitant of attempting to teach EST to students who may be degree-holding, working scientists in their native language.

This paper describes a teaching method developed for a class of nuclear engineers from the Taiwan Nuclear Power Station who came to Oregon State University to upgrade their nuclear engineering skills. All were working engineers with a high level of English. They were to receive ten weeks of English training prior to undertaking a year of graduate level studies in the nuclear engineering department.

The teaching method described herein is based on the assumption that the students know more science than the teacher. In fact, it requires the students to contribute their knowledge to the class in order for the lesson to work. It leaves the teacher in the role of the language expert, a position he has never been required to abandon if one looks closely at what EST (or ESP) is.

To teach EST means to teach a restricted body of language that fits the specific objectives of a particular group of students. Scientists use language to communicate

in specific ways. It is these specific ways of using language that are the business of the language teacher. Science content enters into the teaching of EST because authentic examples of language use are a valid method of language teaching. There are also other reasons, such as the advantages of high motivation and relevance to the students' communication needs, but the point is that EST does not claim that it is the job of the language teacher to teach science. In fact, the lessons developed for the Taiwanese relied on the assumption that the students already knew the science involved in the lessons.

This utilization of student knowledge has two advantages. The students can actively contribute to the class from a position of confidence, and the teacher can concentrate on what he knows best - language.

Before turning to the lesson presented here, some comment should be made on the dynamics of instituting this type of lesson in the classroom. In any teaching situation, there is a social contract between students and teacher. On the first day of class, there is an anarchy of expectations. The students expect to learn and the teacher expects to teach, but the teaching-learning process has not yet been defined. That process begins to be defined the moment the teacher walks in the door. With the initial lesson, the classroom dynamic begins to take shape.

That dynamic can be manipulated. For the Taiwanese lessons, a conscious attempt was made in the teacher's initial comments to make the science that was to be the

conceptual content of the course the responsibility of the students. The teacher, in turn, took responsibility for the language content of the course. This was simple to do and took the form of a statement along the following lines:

> "In this course we are going to look at some of the special ways scientists use English. I am going to present many examples from the nuclear sciences. However, I do not know very much science. What I do know is English. So I'm going to be responsible for the language you need to know, but you must be responsible for being sure that all the science used in this course is correct."

It was thereafter a matter of adhering to the contract. The students appreciated the recognition of their specialized skills, came to contribute their knowledge freely, and enjoyed the opportunity to practice the language in contexts that were obviously relevant to their particular situations.

Teaching "Definition"

Lessons developed for the course covered such topics as definition, classification, conceptual paragraphing, compounding, non-temporal verb choice, and implicit information. The lesson described in this article is the first of three that form a unit, the primary intention of which is to teach definition and classification. The third lesson of the unit reviews definition and classification and introduces

the students to conceptual paragraphing and implicit information in EST discourse. Lesson One, presented below, has been slightly revised for this article, but is essentially the same as the material that was handed out to the students.

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Tai Power 77 EST LESSON #1 Instructor: Drobnic

Subject: Definition

Read:

When scientists write, they often define. An understanding of definition will help you write good reports and comprehend scientific reading material. Definition may be formal, semi-formal, or informal. The method of definition may be by operation, example, purpose, use, function, physical description, or a combination of any of these.

A formal definition has three parts: a term (A), a class (B), and defining information (C). It is expressed as

A is B which C

or,

A = B + C.

Example:

"An atom is a particle of matter ~~indivisible~~ indivisible by chemical means."
A = B + C

This definition both describes an atom (a particle of matter) and tells how it functions (it is indivisible by chemical means).

A semi-formal definition has two parts: a term (A), and defining information (C). This can be expressed as "A is C" or "A = C". Example:

"An atom is indivisible by chemical means."
A = C

"Atom" is here defined by how it functions.

An informal definition may be much less specific than either a formal or semi-formal definition. In the example below, a term is linked to a partial description. Essentially, there is "A + description":

"An atom has an inner part and an outer part."

****

The above was an in-class reading. The reading was explained in detail using the chalkboard and additional examples. Time was allotted for discussion. This led into the second part of the lesson, which requires students to contribute their specialized knowledge. In terms of the classroom dynamic, student responsibility for the success of the lesson is here affixed.

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The Defining Process:

What are two radioactive elements? #1. _____

#2. Uranium

Define #1.:

Define "uranium":

Subcategorize "uranium". Name two isotopes. #1. U-_____

#2. U-_____

Define isotope #1:

Define isotope #2:

Arrange the information above in paragraph form.

"Two radioactive elements are _____ and uranium. _____ is _____ _____. Uranium is _____ _____. There are two isotopes of uranium, U-_____ and U-_____. U-_____ is _____ _____. U-_____ is _____."

****

Where the students were required to supply one other radioactive element besides uranium in the above lesson, they chose plutonium. They then provided formal definitions for both radioactive elements. They subcategorized "uranium" into two isotopes, U-235 and U-238 (while also informing me of other isotopes) and provided definitions for both.

In terms of the classroom dynamic, I at this point confirmed my professed "ignorance of science" by contributing absolutely nothing to the content of this section of the lesson. I simply corrected the grammar of the definitions they wrote on the board, then asked them to explain what the sentences meant. Thus the students gained a clear perception of their role.

The third part of the lesson dealt with the grammar of formal definition. I here reasserted my role as a language teacher. The exercises following this section were assigned as homework. (The word list that formed "III" of the

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homework exercise has been deleted.) These sections of the lesson are self-explanatory and may be found in the appendix.

Conclusions

In EST, we cannot ignore the fact that many language teachers have little training in the sciences. Neither should we ignore the fact that our students often do. I have attempted to describe in this paper a method of utilizing the specific scientific knowledge of the students while keeping the focus of the lesson squarely on the language feature being taught.

This relieves the language teacher of the burden of trying to teach what he does not know. Although relying on the students' scientific knowledge for the approach to work may spawn some initial nervousness, with the Taiwanese nuclear engineers this method resulted in one of the healthiest teaching situations I have experienced in the twelve years I have been involved in language teaching. The students appreciated the relevance of the linguistic knowledge I had to offer, and I came to have confidence in the type of knowledge they had. This inter-reliance kept the lessons from being exercises in linguistic manipulation, and made them instead periods of real communication.

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Appendix: Final Portion of the "Definition" Lesson

The Grammar of Formal Definition:

The formula for formal definition may be written as:

A = B + C.

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Example:

"An atom (A) is (=) a particle of matter (B) that is (+) indivisible... (C)"

Many formal definitions follow this pattern, where

"A" is a noun phrase,

"=" is a "be" verb,

"B" is a noun phrase,

"+" is a relative clause marker (which, that), and

"D" is a relative clause (often reduced).

Exercise: Read the following and prepare a formal definition for "electroscope".

"Though Geiger counters are more sensitive to radiation than electroscopes, both are detectors."

_____ (A) _____ (=) _____ (B) _____ (+) _____ (C).

Now rewrite your definition leaving out the relative clause marker.

_____ (A) _____ (=) _____ (B) _____ (C).

Reversing the formula, rewrite the definition according to "B + C = A". Leave out the relative clause marker.

_____ (B) _____ (C) _____ (=) _____ (A):

Exercises

I. Analyze the following definitions according to the formula "A = B + C". Rewrite those that do not fit the formula.

1. Radioactive elements are elements that spontaneously emit radiation.

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2. Positively charged particles with a mass four times that of the hydrogen atom are alpha rays.

3. Beta rays are negatively charged particles identical with electrons.

4. Gamma rays are of high frequency.

5. The simplest detector sensitive to radiation is the electroscope.

6. A Geiger counter is more sensitive to radiation than an electroscope.

7. Collected from the disintegration of radium, radon is an inert gas.

8. Carnotite is a low-grade uranium ore found in Utah and Colorado.

9. A measurement of radiation dosage is the roentgen unit (r).

(Sentences 1-9 above from COLLEGE CHEMISTRY, King/Caldwell/ Williams. Van Nostrand Reinhold Co., New York, 1972.)

II. What is the method of definition used in each sentence above?

III. Turn to the attached word lists. Divide into small groups and prepare formal definitions for each word on the list.

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